Rare Processes in Relativistic Heavy Ion Collisions--Results from BNL E878

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E878 is a high sensitivity search experiment, designed to investigate rare proceses in relativistic heavy ion collisions, e.g. antibaryon production and the formation of new, previously undiscovered particles. The experiment was conducted at the Alternating Gradient Synchrotron (AGS) at Brookhaven National Laboratory, and is a follow-on to experiment E858. Data were recorded using Au beams on various nuclear targets during the spring of 1992 and the fall of 1993. Over the course of the last two years, analysis of this data has been completed, resulting in several publications and one Ph D thesis.

The primary goal of E878 was a search for strangelets, which are multiquark hadrons made of roughly equal number of u, d and s quarks which have been predicted to be stable. E878 was sensitive to strangelets up to A=30 (90 quarks) with lifetimes of ~100 ns or longer. Our search yielded no strangelet candidates. Sensitivites for positively charged strangelets are shown in figure 1; similar sensitivities were reached for negatively charged strangelets.

The biggest improvement in E878 over its forerunner E858 is the ability to measure the centrality of the nucleus-nucleus collision producing the detected particle. This information has been used to investigate pion and kaon production cross sections, as well as a study of the formation of light nuclei as a function of centrality. Manuscripts of these studies are in the final stages of preparation.

The most interesting use of centrality information in E878 is in the study of antiproton production. As shown in Figure 2, the E878 data differed widely from theoretical predictions for models which heretofore had been quite successful in matching particle spectra. This result has spurred new thinking about how the antiproton annihilation process proceeds in the hot, dense environment of central Au + Au collisions.

Footnotes and References

1 D. Beavis *et al*, Phys. Rev. Lett. 75, 3078 (1995)
2 D. Beavis *et al*, Phys. Rev. Lett. 75, 3633 (1995)

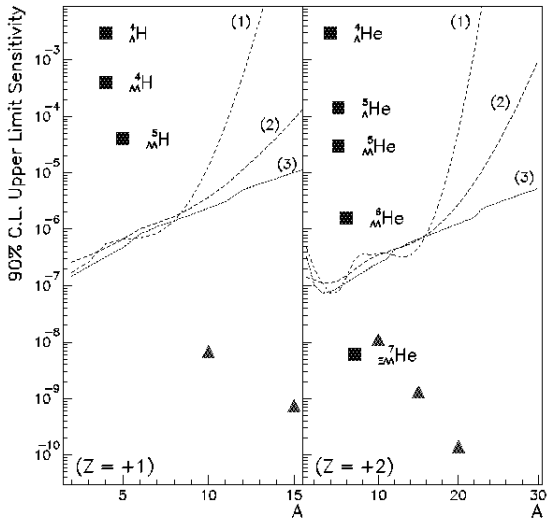

Figure 1. The sensitivity of E878 for the detection of charge +1, +2 strangelets. The three curves are 90% sensitivity upper limits based on specific models of strangelet production. Strangelet predictions of Crawford *et al* are shown as triangles and hypernuclei predictions of Baltz *et al* are shown as squares. [1 and references therein]

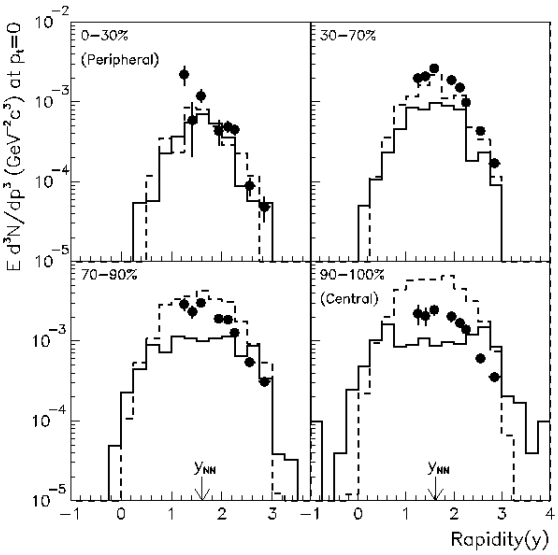

Figure 2. The invariant multiplicities of antiprotons measured in Au + Au collisions plotted as functions of rapidity for four non-overlapping centrality bins. The data are shown as symbols, RQMD calculations as solid lines and ARC calculations as dashed lines. [2 and references therein]